上海交通大学自动化系
Department of Automation
Shanghai Jiao Tong University

系统控制与信息处理教育部重点实验室
Key Laboratory of System Control and Information Processing, Ministry of Education

学术报告会

时间：2024年5月29日 10:30
地点：电信群楼3-200会议室

LQR Learning Pipelines

Prof.Florian Dörfler
Eidgenössische Technische Hochschule Zürich

摘要:

The linear quadratic regulator (LQR) problem is a cornerstone of automatic control, and it has been widely studied in the data-driven setting. In the first part of the talk, we show how to bridge different problem formulations and propose a novel, direct, and regularized version of the LQR. We start from indirect certainty-equivalence LQR, i.e., least-square identification of state-space matrices followed by a nominal model-based design, formalized as a bi-level program. We show how to transform this problem into a single- level, regularized, and direct data-driven control formulation, where the regularizer accounts for the least-square data fitting criterion. For this novel formulation we carry out a robustness and performance analysis in presence of noise. In the second part of the talk, we propose an adaptive method to learn this solution. By adaptive, we mean an online method using closed-loop data, in a non episodic fashion, and with recursive algorithmic implementation. Our approach is based on a covariance parameterization of the direct, data-driven, and regularized LQR and an explicit calculation of the policy gradient using a batch of persistently exciting data. We establish the global convergence of our method via a projected gradient dominance property in presence of bounded noise. Finally, all our theoretical results are validated with simulations and demonstrate the computational and sample efficiency of our method.

简介:

Florian Dörfler is a Professor at the Automatic Control Laboratory at ETH Zürich. He received his Ph.D. degree in Mechanical Engineering from the University of California at Santa Barbara in 2013, and a Diplom degree in Engineering Cybernetics from the University of Stuttgart in 2008. From 2013 to 2014 he was an Assistant Professor at the University of California Los Angeles. He has been serving as the Associate Head of the ETH Zürich Department of Information Technology and Electrical Engineering from 2021 until 2022. His research interests are centered around automatic control, system theory, and optimization. His particular foci are on network systems, data-driven settings, and applications to power systems. He is a recipient of the distinguished young research awards by IFAC (Manfred Thoma Medal 2020) and EUCA (European Control Award 2020). His students were winners or finalists for Best Student Paper awards at the European Control Conference (2013, 2019), the American Control Conference (2016), the Conference on Decision and Control (2020), the PES General Meeting (2020), the PES PowerTech Conference (2017), the International Conference on Intelligent Transportation Systems (2021), and the IEEE CSS Swiss Chapter Young Author Best Journal Paper Award (2022). He is furthermore a recipient of the 2010 ACC Student Best Paper Award, the 2011 O. Hugo Schuck Best Paper Award, the 2012-2014 Automatica Best Paper Award, the 2016 IEEE Circuits and Systems Guillemin-Cauer Best Paper Award, the 2022 IEEE Transactions on Power Electronics Prize Paper Award, and the 2015 UCSB ME Best PhD award. He is currently serving on the council of the European Control Association and as a senior editor of Automatica.